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Memo

DATE: *January 9, 2004*

TO: RHIC E-Coolers

FROM: *Ady Hershcovitch*

SUBJECT: **Minutes of the January 9, 2004 Meeting**

Present: John Cary (TECH-X & Colorado University), Ady Hershcovitch, Jorg Kewisch, Vladimir Litvinenko, Derek Lowenstein, Stephen Peggs, Thomas Roser, Dejan Trbojevic, Jie Wei.

Topics discussed: Simulation & Calculations

Simulation & Calculations: At Ilan's suggestion, Ady calculated collisional temperature isotropization rate in a RHIC Electron beam cooling electron bunch. Since the electrons have an anisotropic temperature distribution, collisions among the electrons lead to temperature isotropization. Ady's analysis is based on plasma physics formulas, which have their origin in the test particle model (Norman Rostoker), and whose final derivation was made by B. A. Trubnikov in the early 1960's (a good reference is Turbnikov "*Particle Interactions in a Fully Ionized Plasma"* in Reviews of Plasma Physics, Volume 1, Consultants Bureau 1965). For the following electron bunch parameters: T_{perp}= 500 eV, T_{paral}= 0.046 eV, and n = $4x10^9$ cm^{-3}, the **initial** isotropization rate is 25.7 sec^{-1}, which corresponds to a temperature isotropization period of about 40 msec (of course as isotropization progresses the rate decreases and the period increases). These computations are valid within the limits of plasma theory, i.e., where plasma collective effects are more important than binary (Rutherford) scattering. Only collisions among electrons are considered.

Jorg pointed out that Derbenev had performed some "back-of-the-envelop" calculations and came up with a comparable isotropization rate. A discussion ensued on how these calculations are related to IBS. It seemed to Ady that most IBS simulations involved Rutherford binary scattering, and that only the TECH-X codes properly treat plasma effects. John Cary explained that TECH-X codes use both plasma and binary scattering where applicable e.g., there is a large portion of particles that are far away from other particles. Those have binary interactions. Other particles that have multiple interaction simultaneously are treated as plasma. Regarding the status of the TECH-X codes, they are being debugged. Finally, in answer to Thomas' question, John Cary said that a new SBIR-I proposal titled "*Smart Particle Electron Cooling Simulations*" was submitted to continue the collaboration with BNL.